

**RESPONSE OF CLUSTERED LADYSLIPPER (*CYPRIPEDIUM  
FASCICULATUM*) TO PARTIAL OVERSTORY REMOVAL AND PRESCRIBED  
FIRE IN NORTH CENTRAL IDAHO**

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The clustered ladyslipper, (*Cypripedium fasciculatum* Kellogg ex S. Watson) is a native North American terrestrial slipper orchid. The full geographical range of the species includes populations found throughout the Klamath and Cascade Ranges in Washington, Oregon, and California, and in the forested mountains of Wyoming, Idaho, Montana, Colorado, and Utah. The species is considered rare and is listed in a number of states within its range, and federally classified as a species of concern (Knecht 1996).

Developing conservation strategies for this species requires greater understanding of its habitat, reproductive ecology, genetic and population structure, and response to disturbance such as fire and opening of overstory canopy. On the NezPerce National Forest at the edge of a large population of this species, a silvicultural treatment that included a shelterwood cut for partial overstory removal and broadcast burning was carried out in 1997. We are studying a portion of the population affected by partial overstory removal and low intensity fire to determine how *C. fasciculatum* responds to this disturbance over time.

## **Methods**

The *C. fasciculatum* population is located on a south facing ridge below FS road 648 in the Granite Creek drainage, South Fork Clearwater River, Nez Perce NF. At that location, 8 circular plots (radius 2 m) were installed to examine the effects of fire, as well as year- to- year growth and reproduction of the population as a whole. Four plots each inside and outside the burned area were monitored. The area in which the burn plots were placed showed no *C. fasciculatum* plants in summer 1997 following the burn.

Monitoring began in the growing season of 1998 one year after the burn took place. A 1/10<sup>th</sup> acre plot was installed in 1997 to collect information on site and plant associations. Plant census was taken in each of the plots in May or June and capsules were noted July or August of 1998, 1999, and 2000. In May or June, number of plants, number of plants flowering and number of flowers per inflorescence on each flowering plant were recorded. In 1999, phenology detailed observations of leaf and flower development were recorded. Leaf opening from first emergence was rated on May 20, 23, and 26 using 1-to-4 based on 1, leaf unfurled; 2, leaf <one-half open; 3, leaf >one half open; and 4, leaf fully expanded. For flowering phenology a rating system of 1-to-4 was given to observed flowering over approximately 2 weeks from May 20 through June 2 as follows: where 1=early bud, 2=mid bud, 3=late bud, 4=open flower.

## Results

Site description: The site is located on a south- to north-east aspect on 15 to 20 % slope. The soil is shallow, sandy loam overlying granite. Duff and litter varies from 4 to 5 cm. The dominant overstory is *Pinus ponderosa* (ponderosa pine) about 125 years old and co-dominant *Pseudotsuga menziesii* (Douglas-fir), about 50 years old. The canopy structure is multi-storied with Douglas-fir the dominant conifer growing into the overstory.

Habitat: The predominant habitat type is Douglas-fir ninebark (PSME/PHMA). Most common shrub associates are *Physocarpus malvaceus*, *Arctostaphylos uva-ursi*, *Spirea betulifolia*, *Symphoricarpus albus*, and *Calamagrostis rubescens*. Common associates in the herbaceous layer are *Arnica latifolia*, *Fragaria vesca*, *Arenaria macrophylla* and *Xerophyllum tenax*. In the bryophyte layer most common mosses are *Rhytidiadelphus triquetrus* and *Brachythecium albicans*; most common lichens identified were *Peltigera* species.

Phenology: Complete phenology data were taken only for 1999. The orchid has only two opposing leaves that first emerge from the crown tightly wrapped or furled. The plants emerged very shortly before May 20, when the first leaf data was taken. Within 6 days

(Table 1), the leaves developed from being less than 1/2 open to completely open. The flowering part of the plant emerged concurrently with the leaves. The inflorescence also developed rapidly—from an early bud to mid-bud stage on May 20 to completely open flower within 11 days (Table 1). The development of capsules was not observed by repeated visits. However, on a visit to the site on July 26, we noted all capsules were mature and a proportion of them had dehisced and were already empty of their seed.

Table 1. CYFA 1999 Phenology data for Idaho population, Granite Creek, NezPerce NF.

Leaf opening was rated 1-5 where 1=leaf unfurled, 2=leaf <.5 open, 3=>.5open, 4=open.

Flower opening was rated 1-4, where 1=early bud, 2=mid bud, 3=late bud, 4=open flower with mean values for each plot and overall mean for the site.

Plot	Plants	<u>Leaf development</u>			<u>Flower development<sup>1</sup></u>				
		Date			Date				
		5/20	5/23	5/26	5/20	5/23	5/26	5/31	6/2
1	4	3.5	3.7	4	2.5	3.5	4	4	4
2	7	2.9	3.9	4	1.6	3	3.6	4	4
3	4	2.9	3.3	4	1.9	1.4	3	3.9	4
4	15	2.9	3.7	4	1.9	3	3.9	4	4
5	1	1	4	4	1.5	2.5	4	4	4
6	15	3.3	3.9	4	1.3	2.4	3.4	3.8	4
7	29	2.6	3.4	4	1.7	2.7	3.6	3.9	4
8	20	2	3.5	4	1.4	2	3.6	4	4
Total	95 Mean	2.6	3.7	4	1.7	2.6	3.6	4.0	4

<sup>1</sup> Total number of flowers by date: 92, 5/20; 84, 5/23; 80, 5/26-6/2.

Response to burning: Number of plants, flowering plants, number of flowers per florescence, and capsule production were recorded on 7 plots for the first, second, and third year post fire (1997). Analysis was performed on 6 plots. One burned plot was not included in the analysis because in years 1999 and 2000 only a single plant was in the plot. In 1998 there were a total of 63 plants of which there were 32 individuals observed

in unburned (U) and 31, on burned (B) plots. In 1999, the number of plants in both U and B plots increased to 80 plants, with an increase of 9 new plants in U plots, and 8 in B plots. In 2000 total number of plants had increased to 95, with an increase of 8 new plants in U plots and an increase of 7 in B plots. The trend in new plants in the B plots appears slightly lower than U but recruitment is exceeding loss over the three years in both (Figure 1). In 2001 the mean number of U plants per plot decreased from the number in 2000 but the B plants remained the same. The snowpack was below normal and the area was drier than normal in spring.

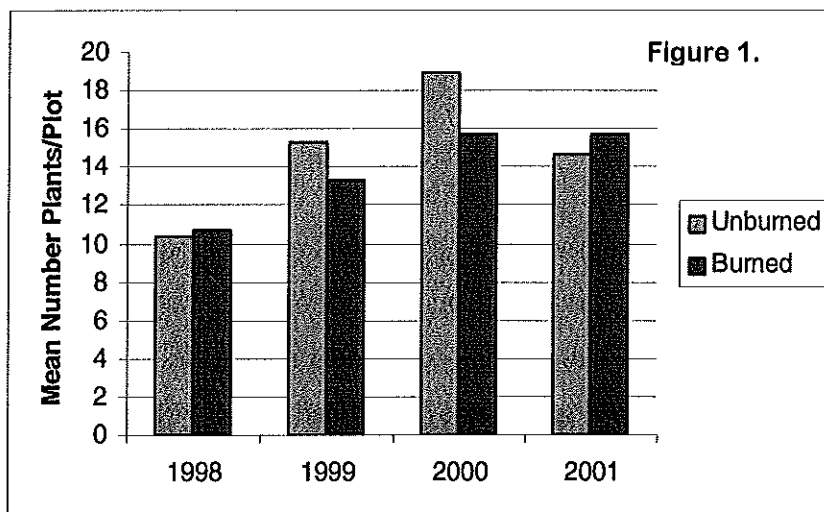


Figure 1. Mean number of plants in burned and unburned plots of *Cypridium fasciculatum* population in Granite Creek drainage, South Fork Clearwater River, Nez Perce National Forest, Idaho.

From 1999 to 2001, the mean proportion of flowering plants changed only slightly in the burned and unburned plots. However, in 1998 the ratio of flowering to total number of plants in U plots was 0.44 with 13 plants having flowers and in B plots, 0.01. In 1999, 23 individuals in U had flowering stems or 0.56, and in B, 12 had flowering stems or 0.43. In 2000 in U plots the number of flowering plants increased to 28, or .53 and in B plots increased to 15 or .38. 1998 the first summer following fire, only a single plant in the burned plots flowered. This may have been because in 1997 the fire burned off all

above-ground plant parts including leaves, and a season of vegetative growth may be required to furnish energy stores for flowering the following season.

The proportion of flowering plants in which the flowers developed seed capsules was higher in the U plots than in the B plots for all years (Figure 2). The successful development of capsules from flowers declined in plants on both U and B plots in 1999 and in 2000 the decline occurred on the B plots only. However, the proportion of flowers that resulted in capsules in 2001 of plants in the B plots recovered to almost that of those in the U plots.

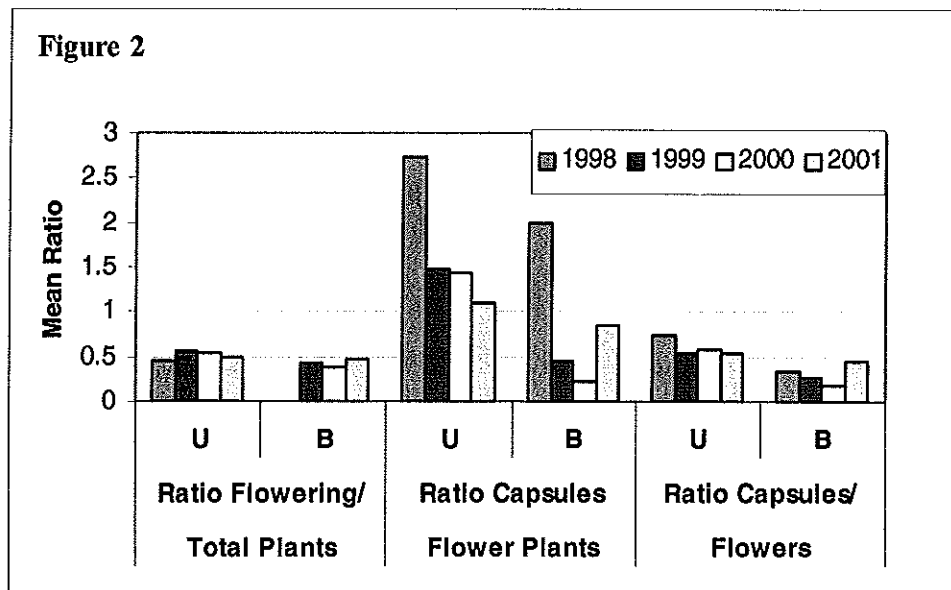


Figure 2. Mean ratio of flowering to total number of plants and mean ratio of developed capsules to flowers in burned and unburned plots located in a *Cypripedium fasciculatum* population on Granite Creek drainage, South Fork Clearwater River watershed, Nez Perce National Forest, Idaho.

The ratio of capsules to flowering plants is lower for the B plants than the U plants, and correspondingly the ratio of capsules to flowers is also lower for the B than the U plants over all years post-fire (Figure 2). It should be noted that the ratio of capsule to flowering plant in 1998 is based on a single plant that flowered in the B plots that year so

is not representative. In years 1999, and 2000 the ratios of capsules to flowering plants and capsules to flowers is less than 0.5 for plants in B plots.

The reduced development in *C. fasciculatum* plants growing in the burned area may be because of loss of cover from the fire. The fire destroyed the protective understory exposing the leaves, flowers and stems of the plants to heat and direct sunlight causing the plants to senesce prematurely. While flowers develop early in the season (Table 1), for these exposed plants, senescence occurred before development to seed was completed. These plants are permanently marked in the monitoring plots and next year will be revisited to determine if premature senescence also reduces vigor and leaf size. The study suggests that the most detrimental effect of fire to long-term population viability may be the loss of appropriate habitat. These plants are able to grow and reproduce in open stands of semi-arid forests as long as they have sufficient cover in the understory. Primary cover for these plants are Douglas-fir saplings and shrubs. These afford protection from predation as well as from direct solar insolation. Other factors may have caused a decrease in fruiting success in 1999 and 2000 overall. These may be related to pollination success. The pollen vector is a small predatory wasp, and may be found to be limiting to seed development. Year to year differences may also be weather related. Herbivory may also play a role and may interact with burning. More plants were observed browsed in the burned than unburned plots suggesting that they may have less protection from browsing animals, or that that new vegetative growth following the burn attracts foraging animals. It should be noted that disturbance in many forms is an ongoing part of the ecosystem in which this species lives. Burrowing animals, herbivores, and physical disturbance all play a role. The success of this species is in the ability of each population to produce seed to disperse and produce seedlings that colonize new microhabitats favorable for growth, and for the long-lived plants in the population to survive until conditions are favorable for growth and reproduction. In that sense the population is not static but a dynamic component of the ecosystem as a whole.